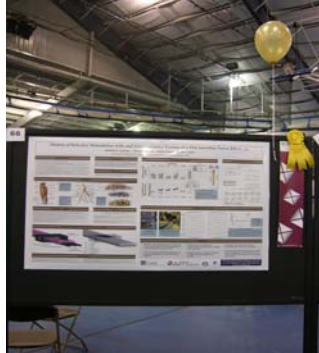


APT CENTER MEMBERS IN THE NEWS

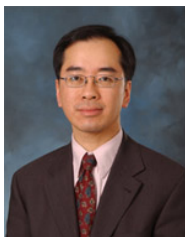
Please join us and congratulate APT Center Investigators and Students who have been featured in publications and/or received recognition for their work.

During Research ShowCASE, an event held in the Veale Convocation Center on the campus of Case Western Reserve University on April 11th and 12th, Graduate student **Matt Schiefer's** Poster Titled: Models of Selective Stimulation with and Intraoperative Testing of a Flat Interface Nerve Electrode received an Honorable Mention.



Also during this premier event Principal Investigator **Dustin Tyler, Ph.D.** was featured in The Value of Research 2006-07 publication in an article titled: "*Connecting with the Nervous System: Integrating Engineered Devices into the Human Body*" (attached). This publication intends to make tangible the scope and importance of the research taking place at Case Western Reserve University.

Our investigators **Jeff Capadona, Ph.D., Pedram Mohseni, Ph.D., Stuart Rowan, Ph.D. and Christian Zorman, Ph.D.** were all featured in the *Case Engineering Magazine* (Spring 2007 Vol. 5 Issue 2 - Attached).



Finally our Investigator **Chester Ho, MD** was selected as a recipient of the 2007 Wings of Excellence Award from the Greater Cleveland Federal Executive Board. This is the highest local honor for federal employees in northeast Ohio.

Congratulations and keep up the good work!



CASE

CASE WESTERN RESERVE UNIVERSITY



The Value of
Research

2006 + 07

Medicine

Connecting with the Nervous System: Integrating Engineered Devices into the Human Body

Improving human health and function through the integration of engineered devices into living biological systems is the research focus of **Dustin Tyler, Ph.D.**, Nord Distinguished Assistant Professor in Case's Department of Biomedical Engineering and associate director at the Advanced Platform Technology (APT) Center. The APT Center and the Cleveland Functional Electrical Stimulation (FES) Center, where Dr. Tyler is an investigator, are both partnerships of Case and the Louis Stokes Cleveland Veterans Affairs Medical Center. The mission of the APT Center is to develop advanced technologies that serve the clinical needs of veterans and other patients with motor and sensory deficits, as well as limb loss, in order to reduce disability, improve daily functions, and enhance their quality of life.

Dr. Tyler and his research team have successfully applied such technologies in a variety of clinical applications including restoration of hand, arm, and leg function in spinal cord injured individuals, as well as improvement of swallowing function following a stroke or central nervous system injury. They are beginning investigation with the technology as interfaces for natural communication between artificial limbs and the amputee. While the engineered devices employed in clinical trials have been successful, they do not yet behave as if they were natural neural tissue—they fall short of interacting with each individual neuron.

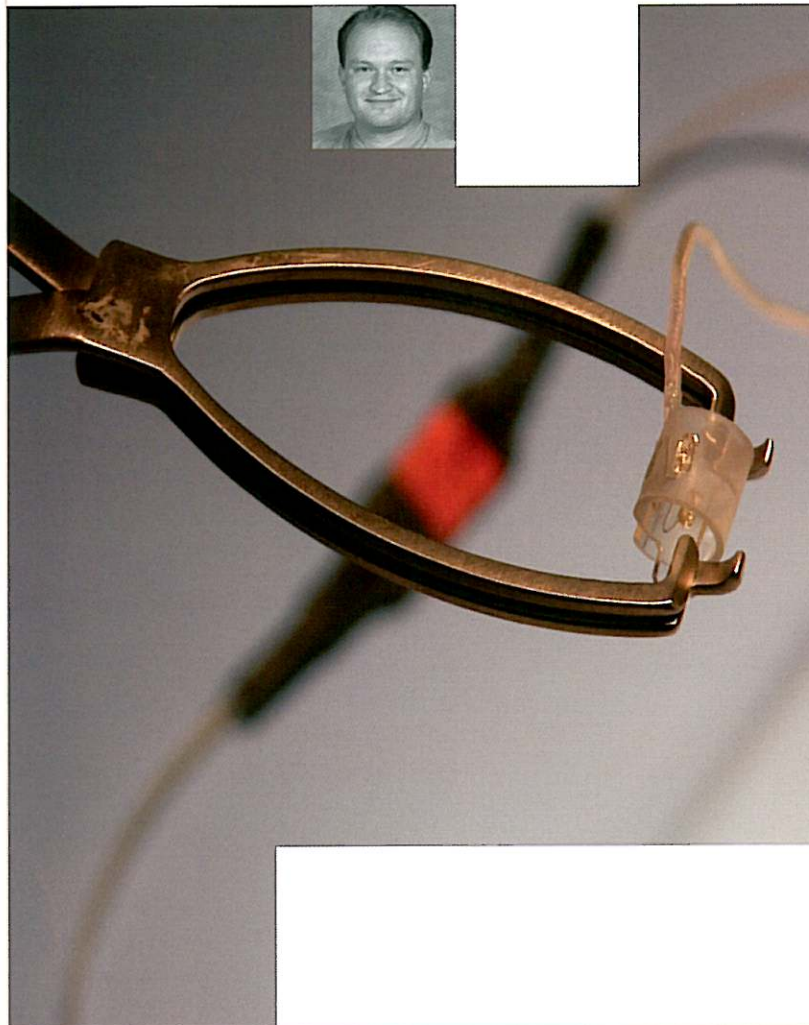
In developing neural interfaces to more efficiently connect engineered systems with biological systems, and specifically with the nervous system, there are many challenges that must be overcome. The nervous system is a dynamic, always evolving system that is sensitive to foreign materials. It consists of thousands of axons in each peripheral nerve and billions of neurons in the brain. More importantly, there are hundreds of connections for each neuron and hundreds of supporting cells—numbers that dwarf even our most advanced microprocessors.

"The challenge is to develop next generation devices that integrate with rather than simply *interact* with the nervous system," notes Dr. Tyler. To this end, his multi-disciplinary research team is developing biomimetic materials with dynamic mechanical properties based on the structure of the sea cucumber. Biomimetics is a research field that incorporates properties that are found in nature into manufactured devices. Because the sea cucumber's skin is composed of collagen fibers

in a matrix-like structure, it can go from a soft, liquid-like state to rigid stiffness. Using this model, the team's first application is to brain implantation devices that need to be stiff for insertion, but then soft to mimic the mechanical properties of the brain for long-term effectiveness. Continued work will incorporate molecular signals and cues to encourage neurons to attach directly to these devices.

"To design and build prototype devices that are clinically meaningful, a broad collaboration is required between biomedical engineering, macromolecular engineering, electrical engineering, chemical engineering, neuroscience, and many other disciplines," adds Dr. Tyler.

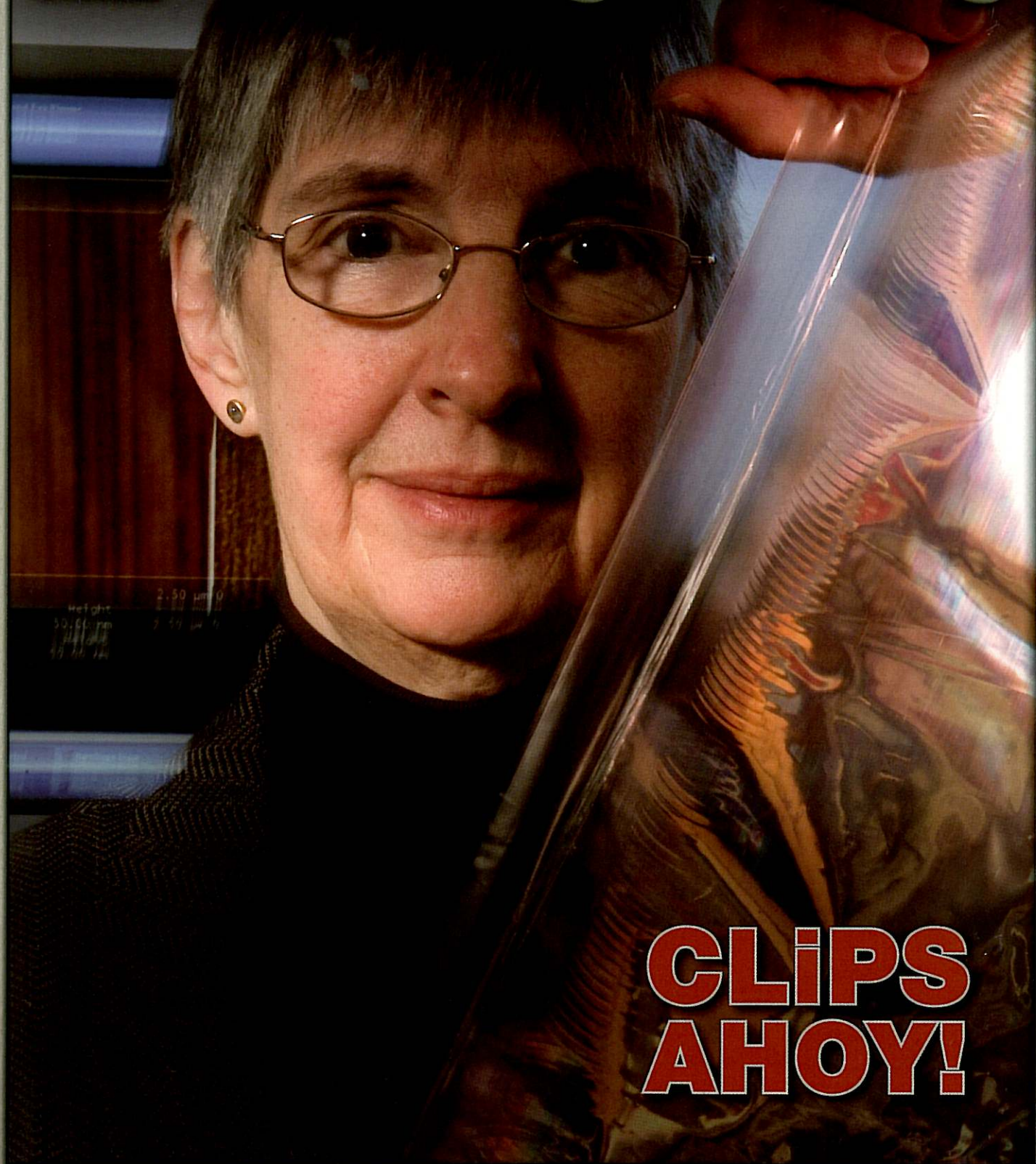
DUSTIN TYLER





CASE WESTERN RESERVE UNIVERSITY SPRING 2007 vol. 5 | issue 2

CASEengineering



CLIPS AHOY!

grad matters: THE DRIVE TO WIN THE DARPA URBAN CHALLENGE /// meet the new dean: TIEN TAKES THE HELM ///
think outside the books: HANDS-ON LEARNING TAKES OFF IN THE NEW SEARS UNDERGRADUATE DESIGN LAB ///

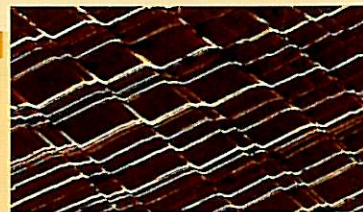
Alexis R. Abramson, assistant professor of mechanical and aerospace engineering, on September 1 began her role as a Nortech Fellow in nanotechnology. In this role, Abramson spends a portion of her time working with Nortech, an economic development organization with a focus on technology, to help guide Northeast Ohio toward innovation by helping companies integrate nanotechnology into their products and processes. Abramson also recently was awarded \$375,000 of a Research and Commercialization Program (RCP) grant awarded by the state of Ohio's Third Frontier program to Graftech International that will investigate synthesizing nanocomposite technologies with graphite-based materials for improved thermal and electrical conductivity. The project will strengthen Ohio's presence in the lightweight, high-performance electronic device market and make it more cost effective. Abramson's laboratory will focus on thermal characterization of the nanocomposites from nano- to micro- to macro-scales.

Eric A. Anderson, a recent Ph.D. recipient in the Department of Mechanical and Aerospace Engineering, was a semi-finalist for the international student award of the European Society of Biomechanics. Anderson, who conducted his research in Professor Melissa Knothe Tate's ThinkTank for Multiscale Computational Modeling of Biomedical and Bio-inspired Systems, presented a podium presentation, titled "Idealization of Pericellular Fluid Space Geometry Strongly Influences the Prediction of Local Stresses Imparted by Fluid Drag on Cell Surfaces." The competition and award conferral took place at the World Congress of Biomechanics in Munich.



Edwin Burwell was named director of the Sears Undergraduate Design Laboratory in the Department of Electrical Engineering and Computer Science.

BIG GRANTS MEAN NEW OPPORTUNITY FOR MATERIALS PARTNERSHIP



Two grants, a \$5.5 million grant from the State of Ohio's Third Frontier Project and a \$1 million grant from the Fred A. Lennon Charitable Trust, will help ensure a bright future for Case's longtime partnership with Solon, Ohio-based Swagelok Company. • The Lennon Trust grant will allow Case to update instrumentation and increase staff in the now-renamed Swagelok Center for Surface Analysis of Materials. First established in 1974 as a center for electron microscopy, the facility has served thousands of academic and industrial partners, including Swagelok, over the last quarter century. • The Third Frontier grant provides support to further research and commercialize a paradigm-shifting technology, called Low-Temperature Colossal Supersaturation (LTCSS), a method for heat-treating austenitic stainless steels that enables take up of large surface carbon concentrations, thereby dramatically improving hardness and other performance characteristics. The research at the university will be conducted by the Case Center for Surface Engineering (CCSE). • Both the Swagelok Center for Surface Analysis of Materials and the CCSE are under the direction of Arthur H. Heuer, University Professor and Kyocera Professor of Materials Science and Engineering at Case and a member of the National Academy of Engineering.

Jeff Capadona, a visiting scientist at the Case School of Engineering, received a \$150,000 Career Development Associate Investigator Award from the U.S. Department of Veterans Affairs. The purpose of the award is to provide a mentored research development experience to highly qualified clinicians and non-clinicians who demonstrate abilities in key areas and present a well-articulated and well-designed career development plan that shows clear commitment to the VA. Capadona, visiting from the APT Center at the Louis Stokes Cleveland VA Medical Center, works under the mentorship of CSE faculty members Dustin Tyler of the Department of Biomedical Engineering and Stuart Rowan and Christoph Weder of the Department of Macromolecular Science and Engineering.

Joshua Caris, a doctoral student in the Department of Materials Science and Engineering, spent the summer working at Sandia National Laboratories as part of his National Physical Sciences

Consortium Fellowship. Caris studies under Professor John Lewandowski.

George Daher was named technician of Sears Undergraduate Design Laboratory in the Department of Electrical Engineering and Computer Science.

Mark De Guire, associate professor of materials science and engineering, co-organized an international symposium, titled "Bioinspired Synthesis and Materials: From Organic Templates to Functional Nanoscale Structures," with colleagues from the Max Planck Institute for Metals Research in Stuttgart, Germany. The meeting was held October 11-14 at Schloss Ringberg, a castle in Rottach-Egern, Germany. This was the third such meeting these collaborators have co-organized at this location since 2001. The meetings have brought together researchers from throughout Europe, Asia and the U.S. to discuss their latest progress in biologically inspired approaches to synthesizing inorganic materials for optical, chemical, electronic and mechanical applications.

▲ continued from page 5

won the award to present her work in Professor Christoph Weder's research group on new mechanochromic polymers at the fall 2006 ACS Meeting in San Francisco.

John Lewandowski, Leonard Case, Jr., Professor of Engineering in the Department of Materials Science and Engineering, was awarded \$150,000 from the U.S. Department of Energy to conduct fracture and fatigue studies on high-performance, corrosion-resistant coatings (HPCRM), bringing total funding of this project to \$507,501. Lewandowski also received \$130,000 from the Office of Naval Research to investigate "Damage Tolerant Fe-Based Bulk Metallic Glasses" and \$60,000 from the Army Research Laboratories to continue to investigate Toughness of Bulk Metallic Glasses and Composites. Lewandowski co-edited, with Professor Phil Withers of the University of Manchester, UK, a special issue in *Materials Science and Technology* on X-ray Tomography; was selected as one of the principal editors of a special issue in *Journal of Materials Research on Metallic Glasses*; contributed to an overview article in a special issue of *MRS Bulletin*; and received Case's John S. Diekhoff Award for Graduate Teaching and Mentoring.



Kenneth A. Loparo, professor of electrical engineering and computer science, was one of five Case faculty members who earned 2006 Excellence in Education honors from *Ohio Magazine*. The award recognizes outstanding college and university educators from across the state.

Ica Manas-Zloczower, professor of macromolecular science and engineering, co-authored a paper, titled "Staggered Passive Micromixers with Fractal Surface Patterning," that was published in the Institute of Physics publishing journal, *Journal of Micromechanics and Microengineering*. Manas-Zloczower also presented a plenary lecture at the PPS regional

meeting in South Africa in October 2006 and has been invited to give lectures at the PPS annual meeting in Brazil in May; the ACS-Rubber Division meeting; and the ninth Brazilian Polymer Congress in Campina Grande, Brazil, in October.

Sarah McBride, a graduate student in Professor Melissa Knothe Tate's Mechanobiology Laboratories in the Department of Biomedical Engineering, was the recipient of an Innovation Incentive Graduate Fellowship award.

Annette Messina, assistant to the chair in electrical engineering and computer science, received a departmental staff award.

Pedram Mohseni, assistant professor of electrical engineering and computer science, participated in a National Academies Keck Futures Initiative Workshop on Smart Prosthetics, titled "Exploring Assistive Devices for the Body and Mind," held November 2006 in Irvine, California. The selection process was based on applications submitted to the National Academies-Keck Foundation, and approximately 100 or so junior and senior investigators across various disciplines were selected nationwide.

Wyatt S. Newman, Herbold Fellow and professor of electrical engineering and computer science, received a departmental faculty teaching award.



Erin Schikowski, a student at Hathaway Brown School in Shaker Heights, was named one of only 40 national finalists in the Intel Science Talent Search (formerly known as the Westinghouse Science Talent Search). Schikowski was named a finalist for research she conducted in the Case School of Engineering's Department of Macromolecular Science and Engineering under the direction of Professor Stuart Rowan and graduate student Blayne McKenzie. The only finalist from Ohio, Schikowski already has won \$1,000 for Hathaway Brown and a laptop and \$6,000 for herself. She and the other finalist go to Washington, D.C., in March for the next and final stage of this event.



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P. Hunter Peckham, Donnell Institute Professor in biomedical engineering, received the 2006 World Technology Network (WTN) Award for Health and Medicine. WTN's membership is comprised of approximately 1,000 members from more than 60 countries, judged by their peers to be the most innovative in the technology world. For a complete list of 2006 award winners, go to <http://www.wtn.net/2006/summit/finalists.html>. Peckham also presented his research at the 2007 meeting of the American Association for the Advancement of Science.

Michael "Misha" Rabinovich, professor of electrical engineering and computer science, received a departmental faculty research award.

Stuart Rowan, associate professor of macromolecular science and engineering, will become a member of the Editorial Advisory Board of the journal, *Macromolecules*. Rowan also received a \$420,000 grant from the NSF-World Materials Network, titled "Healing Polymers: The Self-Assembly Approach," aimed at developing self-healing plastics. Rowan and Christoph Weder, also an associate professor of macromolecular science and engineering, received a \$273,575 grant from the U.S. Army Research Office for their project, titled "Multifunctional Metallosupramolecular Materials."

Adel "Tony" Saada, professor of civil engineering, received the 2006 G. Brooks Earnest Award. The award, given by the Cleveland Section of the American Society of Civil Engineers, recognizes outstanding contributions to the field of civil engineering. As part of the award, Saada was the guest of honor at the 30th annual G. Brooks Earnest Award dinner and presented a lecture, titled "Civil Engineering with a Sense of History: The Stories Behind the Equations."



David Schiraldi, associate professor of macromolecular science and engineering, received a DuPont Science and Engineering Grant for his work in nanocomposites. Schiraldi also presented invited lectures on fuel cell durability at the fall 2006 national meetings of the American Chemical Society and Electrochemical Society.

Chih-Jen "Jackie" Sung, associate professor of mechanical and aerospace engineering, received a three-year, \$450,000 grant from NASA for the study of "Comprehensive Chemical Kinetics of Conventional and Alternative Jet Fuels for Aeropropulsion Combustion Modeling." Sung also recently was elected to the grade of associate fellow in the American Institute of Aeronautics and Astronautics.

Dawn M. Taylor, assistant professor of biomedical engineering, received a merit review through the Louis Stokes Cleveland VA Medical Center. Taylor's project, titled "Minimally Invasive Brain Recordings for Control of FES/Robotic Systems," will receive of \$716,900 over three years. Taylor also served on a panel sponsored by various funding agencies to evaluate the state of technology in brain-computer interfacing around the world. As part of this panel, Taylor visited labs last summer in Germany, Austria and Oxford.

Christian A. Zorman, associate professor of electrical engineering and computer science, received a faculty fellowship from NASA. The fellowship allowed Zorman to spend the summer in the Communications Division of NASA Glenn Research Center developing new materials for RF MEMS switching and wireless communications applications. Zorman also was awarded, with co-PI Dustin Tyler, Nord Distinguished Assistant Professor in biomedical engineering, a three-year, \$240,000 grant from NSF, titled "A Microfabricated Neural Electrode Array for Long Term Implant Applications." The purpose of this project is to explore strategies to

fabricate polymer-based, mechanically flexible stimulation and recording electrodes that are impermeable to moisture and biocompatible.



The Department of Macromolecular Science and Engineering for the third straight year had a student from its summer Research Experience for Undergraduates (REU) program win an award at the NSF-INSPIRE undergraduate polymer research competition. This year's winner was Christine Ander, a junior at SUNY-Fredonia, who won best research talk. The 2005 winner, Matt Gawryla, then a senior at the Rochester Institute of Technology, is now a doctoral student at Case, while 2004 winner, Eric Giles, is a senior at Case. Former program participants Sarah Rasmussen and James Mendez have also received honors at NSF-INSPIRE. Professor David Schiraldi directs the REU program.

